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LISTS OF SPECIES

A checklist of Berberidaceae in Uttarakhand, Western Himalaya, India

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ABSTRACT: In India, Berberidaceae is represented by three genera and 68 species. The largest among genera is Berberis (55 species). Majority of Berberidaceae members are distributed in the Himalayan region. Only four species are found away from the Himalayan region, i.e., Nilgiri hills, Chhota Nagpur and Pachmarhi hills of Madhya Pradesh. Extensive surveys were conducted in various ecoclimatic zones of Uttarakhand between years of 2008 and 2010. For each species encountered, field notes were taken along with the voucher specimen following standard technique. During field survey, field notes, date, locality, habitat and brief identification features were noted. A checklist of 36 taxa of Berberidaceae recorded from the state of Uttarakhand, India, is provided. Of these, 32 belong to genus *Berberis* and four belong to genus *Mahonia*. The present study shows that *Berberis hamiltoniana* Ahrendt and *Berberis apiculata* Ahrendt are new records for Uttarakhand state. *Berberis lambertii* Parker has been rediscovered after a century gap. Nomenclature has been updated as far as possible with the help of available recent taxonomic literature.

INTRODUCTION

The family Berberidaceae was first established by A. L. de Jussieu (1789) as 'Berberides' and was considered one of the most primitive Angiosperms having a high number of disjunct or discontinuous genera (Bruckner 2000). Berberidaceae is a heterogeneous assemblage of angiosperms comprising *ca* 17 genera and 650 species in the world, which are distributed mostly in the northern hemisphere (Chamberlain and Hu 1975; Landrum 1999). *Berberis* is the richest genus (ca. 450 species in the world) and *Mahonia* has ca. 100 species (Ahrendt 1961).

Berberidaceae is characterized by shrubs or perennial herbs with reddish brown to pale branches, armed or unarmed. Several classification systems have been proposed for the extensive character variation in habit, floral morphology and fruit type. On the basis of carpellary anatomy, Chapman (1936) proposed that Berberidaceae and Ranunculaceae arose by parallel evolution from a Proranalian complex.

Taxonomically, *Berberis* is a difficult genus due to extremely high morphological variation, probably affected by environment and hybridization (Rao *et al.* 1998a; Ahrendt 1961). Overlapping characters, especially in leaves, stem, and flower and berry size make field identification often difficult. Leaf texture and serrations vary from season to season and with the age of the plant in some of the species (Tiwari and Adhikari 2011; Rao *et al.* 1998). Ahrendt (1961) gave a comprehensive account of the genus but he compared mostly herbarium specimens and a few living ones grown at the Royal Botanic Gardens, Kew and other places. However, some species described by Ahrendt (1961) are based on a single specimen.

Because of its ornamental and medicinal values, *Berberis* is still widely propagated and sold by nurseries for landscaping purposes in several parts of the USA. Most of the *Berberis* species are shade tolerant, drought resistant, and adjustable to an assortment of open and wooded habitats, wetlands and interrupted areas.

In India, Berberidaceae is represented by three genera and 68 species (Rao and Hajra 1993). Largest among genera is *Berberis*, which has 55 species. Majority (>95%) of them are distributed in the Himalayan region. Only four species are found away from the Himalayan region, i.e., Nilgiri hills, chhota Nagpur and Pachmarhi hills of Madhya Pradesh (Rao *et al.* 1998a). Most of the members of Berberidaceae are found in secondary scrub vegetation. Traditionally foresters and ecologists have identified *Berberis* species as indicators of habitat degradation in the temperate region due to their thorny stem and unpalatable shoots (Champion and Seth 1968). However, a large number of native birds and mammals are known to depend on *Berberis* fruits. *Berberis asiatica*, one of the most common species in the middle hills of Western Himalaya, was known to be the alternate host of dreaded wheat rust *i.e. Puccinia graminis tritici*. Hence, during the early phase of green revolution there was a movement to eradicate *Berberis* spp. from the Himalayan region. Similarly, several species of *Berberis* have been eradicated from the Himalayan region in order to reclaim the hill slopes for agriculture or to extract valuable drug 'Berberidine' from the roots and stem of *B. asiatica, B. aristata* and *B. lycium*.

Bentham and Hooker (1862) treat the family Berberidaceae *sensu lato* including Nandinaceae, Lardizabalaceae and Podophyllaceae in the order Ranales. Nandinaceae do not occur in India, though *Nandia domestica* Thumb., a native of China and Japan, is often cultivated in Assam gardens and elsewhere for bright red berries. Lardizabalaceae and Podophyllaceae are treated as separate families. In India, Genus *Berberis* is represented by eight sections and 14 subsections *viz.*, section Tinctoriae is represented by four subsections with 14 species, section Angulosae is represented by four subsections with 13 species, section Wallichianae is represented by 6 subsections with 10 species and section

Vulgaris and Section Ulicinae is represented by single species, and 13 species of *Mahonia* are found in India (Rao and Hajra 1993; Rao *et al.* 1998a, b). Berberidaceae is represented by two genera, *Berberis* and *Mahonia*, in the state of Uttarakhand. The family is represented by four sections of genus *Berberis* (24 species) and *Mahonia* (3 species) (Rao *et al.* 1998a, b).

The State of Uttarakhand is reported to have 24 species of *Berberis* including all varieties and sub-species; about 32 distinct taxa are found in the State (Rao *et al.* 1998a, b). Six species of genus *Berberis* and one species of *Mahonia* are endemic to the state of Uttarakhand. Further, 14 taxa of *Berberis* are common with Nepal and 20 taxa are common with Western Himalaya. At the same time, several species have a number of eco-types and provenances. Of these, six species are endemic to the State (Rao *et al.* 1998a, b; Uniyal *et al.* 2007). According to the Red Data Book of Indian plants, *Berberis lambertii* is Vulnerable, *B. affinis* and *B. osmastonii* are Rare (Nayar and Sastry 1988) and *Berberis rawatii* falls in the 'Endangered' (EN) B1 a.b (v) category (Tiwari and Adhikari 2011). All these four species are endemic to a few pockets.

There has not been any systematic study on Berberidaceae in Uttarakhand. General collection of plants included Berberidaceae, mentioned in various treatises. All these taxonomic works in Uttarakhand gave a brief account on the occurrence, altitudinal range, habitat and phenology of Berberidaceae. However, most of these works either are on past collections or are based on short surveys. Hence, this study was undertaken with a view to bring out a comprehensive account on taxonomy of Berberidaceae of Uttarakhand.

Materials and Methods

Study site

The state of Uttarakhand lies in the eastern most part of the Western Himalaya within the vast east west expanse of the Himalayan range. Situated between 28°53'24" – 31°27'50" N, 77°34'27" – 81°02'22" E, it occupies an area of 53,483 km^2, which accounts for about 1.62% of the total area of the country (Figure 1). The region is predominantly mountainous with exceptions in the South, where plains areas occur along the foothills. The altitude ranges from 300 m to 7,817 m (Nanda Devi peak). The climate of Uttarakhand varies from subtropical to alpine. It is relatively cool and humid compared to rest of the Western Himalaya. Except inner dry ranges, much of the state receives high precipitation during monsoon and heavy snow during winter at higher altitudes (> 2,000 m). Champion and Seth (1968) categories of forest vegetation in the state are Moist Alpine Scrub, Sub-alpine Forests, Himalayan Dry Temperate Forests, Himalayan Moist Temperate Forests, Sub-Tropical Pine Forests, Swamp Forests, and Tropical Deciduous Forests.

The state has approximately one third of its area under alpine region, which is very rich in herbaceous species, including several terrestrial orchids. This diversity of vegetation types harbours growth of ecologically diverse *Berberis* species in the state.

Data collection

Extensive surveys were conducted in various ecoclimatic zones of Uttarakhand between years of 2008 and 2010. For each species encountered, field notes were taken along with the voucher specimen following standard technique (Jain and Rau 1977). During the field survey, field notes, date, locality, habitat and brief identification features were noted. The following herbaria and libraries were consulted for identification: Wildlife Institute of India, Dehradun (WII); Forest Research Institute, Dehradun (DD), India; Botanical Survey of India, Dehradun (BSD); Central National Herbarium, Howrah (CAL), India; Royal Botanic Gardens (K), Kew, U.K.; The Natural History Museum (BM), London, U.K.; Conservatoire et Jardin botaniques de la Ville de Genève (CJB), Geneva, Switzerland,; Botanisches Museum der K. K. Universitaet (WU), Vienna, Austria; National Botanic Garden (LWG), Lucknow, Uttar Pradesh, India.

Accepted names are provided in italicised, boldfaced and basionyms in italicized font. The list is arranged according to the classification given by Rao *et al.* (1998 a, b). Citation of authors' names follows Brummitt and Powell (1992). Habit for each species has been provided after the author citation. Collector numbers are provided

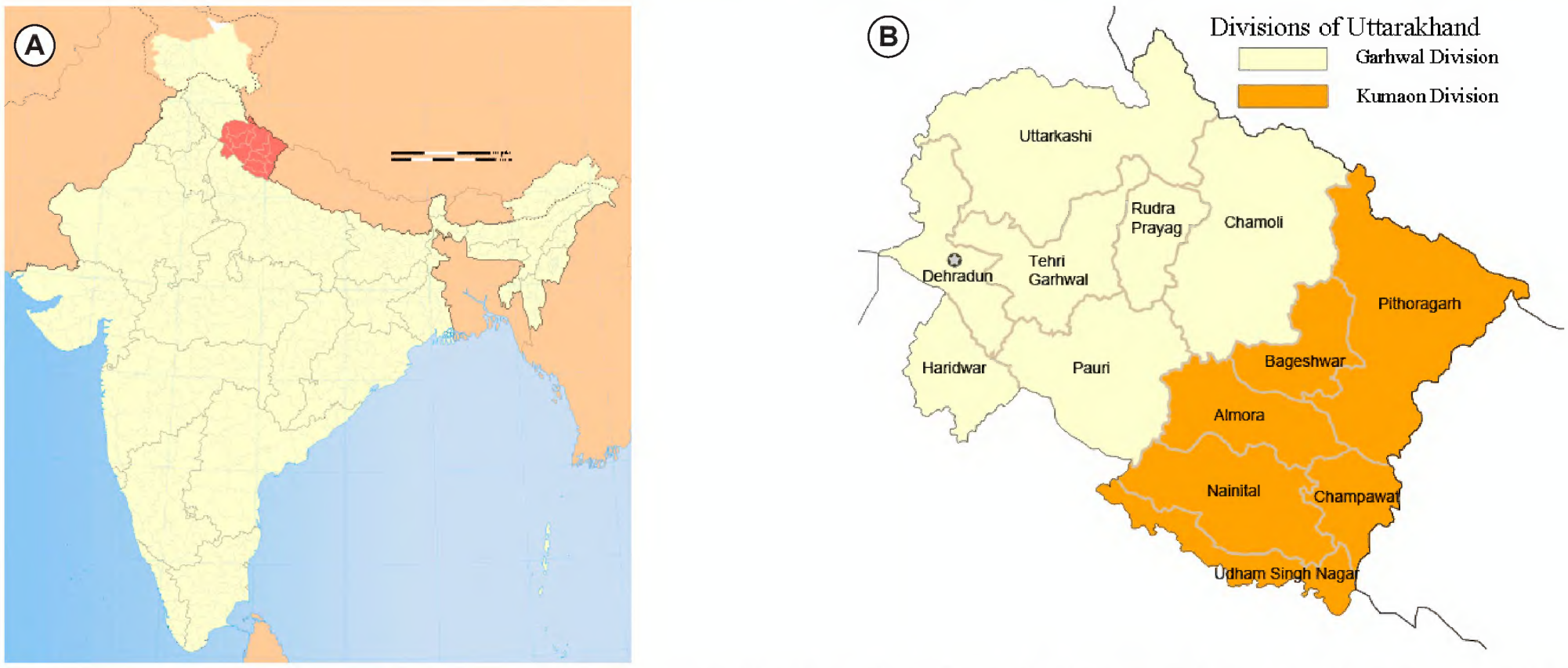

Table 1. A) Map of India showing the location of the state of Uttarakhand in red; B) Map of the divisions and districts of the state of Uttarakhand. Sources: Wikipedia.

for each species. The voucher specimens in the form of herbarium sheets have been deposited at WII.

Results and Discussion

Perusal of literature and past collections housed in the national herbaria revealed that Berberidaceae was represented by two genera, 27 species and nine sub-species in the state of Uttarakhand (Tiwari and Adhikari 2011). Detailed floristic survey and taxonomic evaluation revealed that this state has as many as 36 taxa, which is the highest number for any of the Himalayan states (Table 1). Populations of two endemic species, *B. lambertii* and *B. ahrendtii*, have been located and collected after a gap of 100 years. After proper investigation of Rao *et al.* (1998), Uniyal *et al.* (2007) and Tiwari and Adhikari (2011), it was indicated that *Berberis apiculata* and *B. hamiltoniana* are two new species records for Uttarakhand state. Further *Berberis lambertii* and *Berberis ahrendtii* has been rediscovered after a century gap. It was observed that many species like *Berberis lambertii* have not been recollected after their first report and some are reported but their occurrence in Uttarakhand seems very doubtful. Some species like *Berberis petiolaris* var. *garhwalana*, *Berberis pachyacantha* subsp. *zabeliana*, *Berberis petiolaris* var. *extensa* and *Berberis affinis* are of doubtful occurrence as they have not been collected during the present work. Species like *Berberis cretica*, *Berberis concinna* var. *breviora* and *Berberis floribunda* have been added on the authority of Ahrendt (1961). *Mahonia borealis* has been added on the authority of Takeda (1917).

With this study 24 taxa of Berberidaceae were collected and their morphology and ecotypes' variation were studied. This is a first kind of work for the State. 12 taxa were not collected from field and their taxonomy and status is ambiguous.

Table 1. Checklist of Berberidaceae of Uttarakhand, India (Rao *et al.* 1998 a, b).

GENUS	SECTIONS	SUB-SECTIONS	SPECIES
Berberis	Tinctoriae	Chitriae	**1) *Berberis affinis* G. Don** (Endemic to Uttarakhand) Synonym: *Berberis floribunda* var. *affinis* Ahrendt Specimens examined: Kumaon- Namik, 7700 ft., Strachey and Winterbottom 4 (BM). Flowering and fruiting: March-July (Rao *et al.* 1998a). Altitudinal range: 2200-2700 m (Rao *et al.* 1998). Habitat: It is found in Kharsu aOak and Kharsu Mixed forest at cool temperate zone in the State, 2300-3000 m in Western Himalaya (Rao *et al.* 1998a).
			2) *Berberis aristata* DC. Synonym: *Berberis umbellata* Lindl. Specimens examined: Phoolchatti, Yamuna Valley, 2287 m, 13.5.2008, UKT 0005, 0006, 0007 and 0008 (WII). Flowering and fruiting: March-July. Altitudinal range: 2200-3200 m. Habitat: This species is very common in Open canopy cover and 10-30% forest cover at an altitude range between 2200 to 3200 m.
			3) *Berberis chitria* Buch.-Ham. ex Lindl. Synonym: *Berberis chitria* Ahrendt; *Berberis chitria* var. *occidentalis* Ahrendt. Specimens examined: Phoolchatti, Yamuna Valley, 2288 m, 13.5.2008, UKT 0004 (WII). Flowering and fruiting: May-September. Altitudinal range: 1550-3300 m. Habitat: This species is common at an elevation of 1500-3000 m in Western Himalaya above 30% forest cover.
			4) *Berberis coriaria* Royle ex Lindl. var. *coriaria* Synonym: *Berberis coriaria* var. *patula* Ahrendt Specimens examined: B. D. Naithani 42141 (BSD); Pithoragarh, Chaudans, 13.07.1886, J. F. Duthie 5310 (DD). Flowering and fruiting: May–October (Rao *et al.* 1998a). Altitudinal range: 2000-3000 m (Rao *et al.* 1998). Habitat: This species is very common in above 30% forest cover at an altitude range between 1550 to 3300 m.
			5) *Berberis coriaria* Royle ex Lindl. var. *patula* Ahrendt **(Endemic to Uttarakhand)** Specimens examined: Deota, 2780 m, 20. 5. 1898, Duthie s.n. (BM); Uttarkashi Dist., near Naradchattii on way to Yamnotri, 2300 m, 8.6.1992, B. Datt and B. Lal 212275 (LWG). Flowering and fruiting: May–October (Rao *et al.* 1998a). Altitudinal range: 2200-3000 m (Rao *et al.* 1998) Habitat: Distribution range between 2200-3000 m in the Himalayas (Rao *et al.* 1998a).
			6) *Berberis floribunda* Wall. ex G. Don Specimens examined: Chamoli Bhyunder valley, 2700 m, 23.09.1963, U. C. Bhattacharyya 29650 (BSD). Type: Wallich 1474 (4A, 5B) (K). Flowering and fruiting: May–September (Rao *et al.* 1998a). Altitudinal range: 2500-3000 m (Rao *et al.* 1998). Habitat: Status is not known and its distribution in the State is ambiguous, Himalayas, 2700-3500 m (Rao *et al.* 1998a).

Table 1. ***Continued.***

GENUS	SECTIONS	SUB-SECTIONS	SPECIES
			7) *Berberis macracantha* Schrader Specimens examined: Uttarakhand; Chamoli Dist., Tungnath, 2700 m, 17.10.1992, T. Husain and B. Datt 210593 (LWG). Flowering and fruiting: October (Rao *et al.* 1998a) Altitudinal range: 2500-2800 m (Rao *et al.* 1998) Habitat: Status is not known and its distribution in the State is ambiguous, Himalayas, 2500-2800 m (Rao *et al.* 1998).
Berberis	Tinctoriae	Eutinctoriae	**8) *Berberis petiolaris* var. *extensa* Ahrendt ex Rao, Husain et B. Datt** Specimens examined: Tehri Garhwal, Tali, A. K. Goel 66624 (BSD). Type: Nepal: Sialgarhi, Bhauahabisa, Khola, 3000 m, 19.5.1952, Polunin, Sykes and Williams 2066 (holo-BM). Flowering and fruiting: May-June. Altitudinal range: 2500-3200 m (Rao *et al.* 1998). Habitat: Status is not known and its distribution in the State is ambiguous, Himalayas, 2500-3200 m (Rao *et al.* 1998).
			9) *Berberis petiolaris* var. *garhwalana* Ahrendt. (Endemic to Uttarakhand) Specimens examined: Tunghasi, 8000 ft., Strachey and Winterbottom 5 (holotype - BM). Type: Garhwal: Tunghasi, 8000 fl., Strachey and Winterbottom 5 Holpotype- BM). Flowering and fruiting: May-June. Altitudinal range: 2500-3300 m (Rao *et al.* 1998). Habitat: Status is not known and its distribution in the State is ambiguous; Himalayas, 2500-3300 m (Rao *et al.* 1998).
Berberis	Tinctoriae	Umbellatae	**10) *Berberis umbellata* Wall. ex G. Don** Specimens examined: Jhala, Uttarkashi, 2700 m, 02.07.2010, UKT 2086 (WII). Type: Nepal: 1818, Wallich 1475, in p.p. Flowering and fruiting: May-August. Altitudinal range: 2600-3600 m. Habitat: It is common in subalpine and alpine meadows at an altitudinal range between 2850-4000 m.
Berberis	Asiaticae		**11) *Berberis ahrendtii* R. R. Rao and Uniyal (Endemic to Uttarakhand)** Synonym: *Berberis lycioides* Stapf Specimens examined: Pangarbassa, Chamoli, 2680 m, 10.5.2009, UKT 0989 (WII). Type: Cultivated: Fl. June, 1939; Fr. 27 Sept., 1939 (BM). Flowering and fruiting: April-October. Altitudinal range: 2200-3000 m (Rao *et al.* 1998). Habitat: Open canopy in Kharsu Mixed and Banj Oak forests near Pangarbassa and Bairangana village in Chamoli district.
			12) *Berberis asiatica* Roxb. ex DC. Synonym: *Berberis asiatica* var. *clarkeana* C. K. Schneid. Specimens examined: Kolhukhet, on way to Mussoorie, 1200 m, 1.6.2008, UKT 0170 (WII). Holotype: Wallich s.n. (CJB). Flowering and fruiting: February-July. Altitudinal range: 600-2700 m. Habitat: Sub-Himalayan ranges, hillsides and valleys, sometimes associated with *Quercus* and *Rhododendron*; 900-2500 m.
			13) *Berberis glaucocarpa* Stapf Specimens examined: Deoban, Chakrata, 2590 m, 27.04.2009, UKT 0963 (WII). Type: Jaunsar: Hills between Tons and Giri rivers, 8000 ft., May 1875, Brandis 746 (holo - K). Flowering and fruiting: May-September. Altitudinal range: 2500-3500 m. Habitat: In open shrubby places; 2100-3000 m (Rao et al. 1998a).
			14) *Berberis lycium* Royle *lycium* Specimens examined: Nainbag, Tehri garhwal, 850 m, 12.5.2008, UKT 0001 (WII); Barkot, Uttarkashi, 1449 m, 12.5.2003, UKT 0003 (WII); Biyali, Uttarkashi, 2050 m, 13.5.2008, UKT 0001 (WII); Deota, Uttarkashi, 1366 m, 14.7.2008, UKT 0377 (WII); Wazri, Uttarkashi, 2002 m, 15.4.2009, UKT 0936 (WII); Kuthnor, Uttarkashi, 1800 m, 15.4.2009, UKT 0937 (WII); Gopeshwar, Chamoli, 1548 m, 14.4.2010, UKT 2065 (WII); Mandal, Chamoli, 1520 m, 15.4.2010, UKT 2067 (WII). Holotype: Kashmir: Royle s.n. (K). Flowering and fruiting: February-July. Altitudinal range: 600-2700 m. Habitat: It has distribution in Subtropical to Temperate zone in Garhwal Himalaya.
			15) *Berberis lycium* var. *simlensis* Ahrendt Specimens examined: Barkot, 1200 m, 6.6.1992, B. Datt and B. Lal 212274 (LWG); Kalyani, 1550 m, 30.5.1992, B. Datt and B. Lal 212225 (LWG); Kuthnor vill., 9.6.1992, B. Datt and B. Lal 210588 (LWG). Type: Punjab Himalaya: Simla. 7000 ft., July 1885, Collett 234 (holotype - K).

Table 1. ***Continued.***

GENUS	SECTIONS	SUB-SECTIONS	SPECIES
			Flowering and fruiting: February-July. Altitudinal range: 1500-2700 m (Rao *et al.* 1998) Habitat: Status is not known and its distribution in the State is ambiguous.
			16) *Berberis lycium* var. *subfascicularis* Ahrendt Specimens examined: Uttarkashi Dist., Bhankoli village, 2000 m, 30.5.1992, B. Datt and B. Lal 212229, 212228 (LWG); Uttarkashi Dist., Kalyani, 1550 m, 30.5.1992, B. Datt and B. Lal 212230 (LWG). Type: Kashmir, Kistwar Dist., Tsingana, 6500 ft, Ludlow and Sherriff 9105 (Holotype - BM). Flowering and fruiting: February-July. Altitudinal range: 1500-2700 m (Rao *et al.* 1998) Habitat: Status is not known and its distribution in the State is ambiguous.
Berberis	Asiaticae		**17) *Berberis lycium* var. *subvirescens* Ahrendt** Specimens examined: Uttarkashi Dist., Kuthnor, 9.6.1992, B. Datt and B. Lal 210588 (LWG); Kalyani, 1550 m, 30.5.1992, B. Datt and B. Lal 212232 (LWG). Type: Kashmir: Gandarbal, Sind valley, 5200 ft., 31 May, 1940, Ludlow and Sherriff 8095 (holo - BM). Flowering and fruiting: February-July. Altitudinal range: 1500-2700 m (Rao *et al.* 1998). Habitat: Status is not known and its distribution in the State is ambiguous.
Berberis	Angulosae	Euangulosae	**18) *Berberis concinna* Hook. f. var. *breviora* Ahrendt** Specimens examined: Garhwal, 04.09.1885, Duthie 1816 (CAL). Type: Nepal: Namlang, 9000 ft, 28 Oct. 1931, K.N. Sharma E269 (holotype - BM). Flowering and fruiting: June-October. Habitat: In Rocky crevices at an altitude between 3000-4500 m (Rao *et al.* 1998b).
			19) *Berberis kumaonensis* C. K. Schneid. Specimens examined: Garbyang Village, Kali valley, Pithoragarh, 3125 m, 07.07.2010, UKT 2098 (WII). Type: Kumaon: Rocks near Garbyang, Kali valley, 13000 ft., 15 sept. 1894, Duthie 2697 (K and CJB). Flowering and fruiting: May-September. Altitudinal range: 2800-3400 m. Habitat: This species grows in open canopy cover at an altitude of 2500-4500 m in the State.
Berberis	Angulosae	Jaeschkeane	**20) *Berberis apiculata* (Ahrendt) Ahrendt (New Record for the State)** Synonym: *Berberis jaeschkeana* var. *apiculata* (Ahrendt) H. B. Naithani and S. N. Biswas. Specimens examined: Gangori, on way to Har-ki-Dun, Uttarkashi, 2280 m, 8.7.2010, UKT 0210 (WII). Flowering and fruiting: May-August. Altitudinal range: 2200-3000 m. Habitat: On the banks of streams and open dry places on hill slopes 2200-2500 m near Gangori village on way to Harki-Dun in Tins valley.
			21) *Berberis hamiltoniana* Ahrendt (New Record for the State) Specimens examined: Kushkalyani, Uttarkashi, 3350 m, 3.7.2010, UKT 2087 (WII). Flowering and fruiting: June-October. Altitudinal range: 2500-3400 m. Habitat: Stony hillsides, dry slopes, along the boulders on river banks of Kali in Pithoragarh district; 2875-4500 m.
			22) *Berberis jaeschkeana* C. K. Schneid. Specimens examined: Chopta, on way to Tunganath temple, Chamoli, 2988 m, 09.05.2009, UKT 0980 (WII). Type: Kashmir: Falconer 97 (holo - K). Flowering and fruiting: May-August. Altitudinal range: 2800-3600 m. Habitat: Forming dense patches on rocky or sandy slopes among boulders at an altitude of 2200-5200 m in the State.
			23) *Berberis jaeschkeana* var. *usteriana* C. K. Schneid. Synonym: *Berberis usteriana* (C.K.Schneid.) R. Parker Specimens examined: Gunji village, Kali valley, Pithoragarh, 3175 m, 08.07.2010, UKT 2100 (WII). Type: Kumaon: Chelab, Byans, Duthie 5307 (holotype - K). Flowering and fruiting: June-September. Altitudinal range: 2900-3600 m. Habitat: This species grow in open canopy cover and in alpine meadows in Kali river valley in Eastern Kumaon at an altitude of 2850-4500 m.
			24) *Berberis lambertii* R. Parker (Endemic to Uttarakhand) Specimens examined: Humidhura, Pithoragarh, 2802 m, 11.04.2010, UKT 2035 (WII). Holotype: Kumaon: Almora, Lambert s.n. (holotype - K). Flowering and fruiting: May-September. Altitudinal range: 2650-2900 m. Habitat: *Berberis lambertii*, an endemic taxon to the eastern Kumaon in Pithoragarh district, is Critically

Table 1. ***Continued.***

GENUS	SECTIONS	SUB-SECTIONS	SPECIES
Berberis	Angulosae	Jaeschkeane	Endangered (CR). It has extremely patchy distribution and small population. It is a perennial shrub, 0.5 to 1 m high with a few branches. It has only two populations between Ratapani and Humidhura (N - 30.03673°; E - 80.19304°). A total of 37 individuals was present near Betulidhar closer to Humidhura on a temperate grassy slopes while there were 81 individuals located near Kalamuni in South-West facing slope, at the edge of Kharsu Oak Mixed Forest.
			25) *Berberis osmastonii* Dunn (Endemic to Uttarakhand) Specimens examined: Muniyalikhet, Pindar Valley, Chamoli, 2170 m, 10.5.2009, UKT 0986 (WII). Type: Garhwal, 8000-9000 ft, 12.5.1915, Osmaston 225 (holo - K). Flowering and fruiting: April-May. Altitudinal range: 2200-2800 m. Habitat: *Berberis osmastonii* is found and reported from two localities in the State, viz., Muniyalikhet (Chamoli district) and Kalamuni to Betulidhar (Pithoragarh). Distribution of *B. osmastonii* ranged in altitude between 2200-2800 m at Muniyalikhet and occupies cool-temperate belt.
Berberis	Vulgares		**26) *Berberis pachyacantha* Bien. ex Koehne** Specimens examined: Bhyundar valley, Chamoli, 3006 m, 01.07.2009, UKT 1042 (WII). Flowering and fruiting: April-August. Altitudinal range: 2900-3400 m. Habitat: Moist shady localities at 2000-3300 m altitude.
			27) *Berberis pachyacantha* subsp. *zabeliana* (C. K. Schneid.) Jafri Synonym: *Berberis zabeliana* C.K. Schneid. Specimens examined: Kashmir-India, 1864, Falconer 95 (holotype-K). Type: India: Kashmir, Falconer 95 (K). Flowering and fruiting: April-August. Altitudinal range: 2800-3400 m (Rao *et al.* 1998). Habitat: Dry open places; 2100 m (Rao *et al.* 1998b).
Berberis	Polyanthae		**28) *Berberis koehneana* C.K. Schneid.** Specimens examined: Budhi Village, Kali valley, Pithoragarh, 2650 m, 06.07.2010, UKT 2092 (WII). Type: India: Uttarakhand. Kumaon, Budhi, Byans, 8-9000 ft., Duthie 5309 (WU). Flowering and fruiting: May–November. Altitudinal range: 2800-3400 m. Habitat: This species grows in *Abies* spp. and *Pinus wallichiana* forest in easten Kumaon along the Kali river valley from Bhudhi village to Gunji at an altitude from 2800 to 3300 m.
			29) *Berberis kunawurensis* Royle Synonym: *Berberis edgeworthiana* Schneid., *Berberis vulgaris* L. var. *brachybotrys* Hook. f. and Thorns. Specimens examined: Sukhi village, Uttarkashi, 2700 m, 30.06.20110, UKT 2082 (WII). Type: Punjab: Kunawur, 1834, Royle s.n. (K). Flowering and fruiting: May–September. Altitudinal range: 2600-3000 m. Habitat: This species grows in open canopy cover at an altitude of 2600-3000 m in the State.
Berberis	Hetropodae	Creticae	**30) *Berberis cretica* L.** Synonym: *Berberis vulgaris* var. *cretica* (L.) Hook.f. and Thoms. Specimens examined: Specimen are not collected from India. Montagnes de Lakous, 20. 6. 1883, Elisee Reverchon, 7 (DD). Flowering and fruiting: May–July (Rao *et al.* 1998). Altitudinal range: 2800-3400 m (Rao *et al.* 1998). Habitat: Status is not known and its distribution in the State is ambiguous, Himalayas, 2800-3400 m (Rao *et al.* 1998).
			31) *Berberis rawatii* Tiwari et Adhikari (Endemic to Uttarakhand) Specimens examined: India: Uttarakhand, Muniyalikhet, Pindar valley, 2340 m., 16 April 2009, Umeshkumar L. Tiwari UKT-935 (holotype - WII). Flowering and fruiting: April–May. Altitudinal range: 2200-2800 m. Habitat: *Berberis rawatii* is restricted to three different localities in the State. Distribution of *B. rawatii* ranged in altitude between 2200-2800 m at Muniyalikhet and occupies cool-temperate belt. However, it has larger population at Muniyalikhet along same altitudinal range as in case of *B. osmastonii.* Characteristic habitat for both the species was South facing dry grassy slope. However, *B. osmastonii* showed wider ecological amplitude as compared to *B. rawatii* and *B. lambertii* as indicated by number of populations, altitudinal range, substrate and overall distribution.
Berberis	Hetropodae	Pseudoumbellatae	**32) *Berberis pseudumbellata* R. Parker** Specimens examined: Chamoli Dist., Malari, ca. 3118 m, 03.07.2009, UKT-1055 (WII). Flowering and fruiting: May-October. Altitudinal range: 3100-3300 m. Habitat: In *Cedrus deodara* and *Pinus wallichiana* forest; 3100-3300 m.

Table 1. ***Continued.***

GENUS	SECTIONS	SUB-SECTIONS	SPECIES
Mahonia	Longibracteatae	Acanthifoliae	**33) *Mahonia acanthifolia* G. Don,** Specimens examined: Kumaon - Blinkworth, s.n.; Darjeeling, Thio gapsek kum, 7000-8000 ft., fl. Hooker 41 (K), May, 6000 ft., Drummond 14814 (K), a specimen with leaflets thinner and more dentate; Darjeeling, Oct. 1874, Gamble 1032 (K), and Mar. 1877, Gamble 403SB (K); 1880, Gamble 8561 (K); Assam: Naga Hills, Japvo, 8000 ft., on precipitous densely forested slopes, not rare, 24 Nov. 1949, Kingdon-Ward 19088 (BM). Holotype: Nepal: 1821, Wallich 1480 (Type - K); Syn-type: Pundoah, 1820, Wallich 1480C (K). Flowering and fruiting: October-November (Rao and Hajra 1993). Altitudinal range: 2000-2800 m (Rao and Hajra 1993). Habitat: Status is not known and its distribution in the State is ambiguous.
Mahonia	Longibracteatae	Acanthifoliae	**34) *Mahonia borealis* Takeda** Specimens examined: Mussoorie, 1980 m, 09.03.2009; UKT-0501 (WII). Type: Royle, s.n.; Tehri: 7000 ft., Mussoorie, 1892. Flowering and fruiting: February-April (Rao and Hajra 1993). Altitudinal range: 1800-2500 m (Rao and Hajra 1993) Habitat: Status is not known and its distribution in the State is ambiguous.
Mahonia	Longibracteatae	Acanthifoliae	**35) *Mahonia jaunsarensis* Ahrendt (Endemic to Uttarakhand)** Synonym: *Berberis jaunsarensis* (Ahrendt) Laferr. Specimens examined: Chakrata, 1878 m, 08.03.2009; UKT-0495 (WII). Type: Chakrata, 7000 ft., fl. 9 Apr. 1897, Rich 3 (B 33) (K). Flowering and fruiting: February-April. Altitudinal range: 2000-2600 m. Habitat: Inside Banj Oak forest in state in moist valley, a large shrub common in moist places, and under oak forests near Chakrata.
Mahonia	Longibracteatae	Napaulenses	**36) *Mahonia napaulensis* DC.** Synonym: *Mahonia acanthifolia* Wall. ex G. Don Specimens examined: Naranihetty, fl. 15.11.1802, Hamilton, s.n. (Isotype - K). Isotype: Naranihetty, 15.11.1802, Hamilton, s.n. (K). Flowering and fruiting: February-April. Altitudinal range: 2000-2700 m (Rao and Hajra 1993). Habitat: Inside Banj Oak forest in the State in moist valley.

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